



First Operation of the Liquid Argon Purity Demonstrator (LAPD)



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Why LAPD?

- Currently operating systems such as test stands at FNAL and ArgoNeuT use evacuation as the first step to achieve high purity (electron lifetime)
- Building large vessels that can be evacuated is expensive - scales the cost by at least a factor of 2 for small vessels, more for large vessels
- Want an alternative to evacuation for large vessels - LAPD is test stand at FNAL to study possibility of filling without evacuation
- Makes use of previous FNAL experience in design of system
- Need to show a lifetime of 3 ms for a 2.5 m drift distance





System Flow

Inline Purity

Monitor

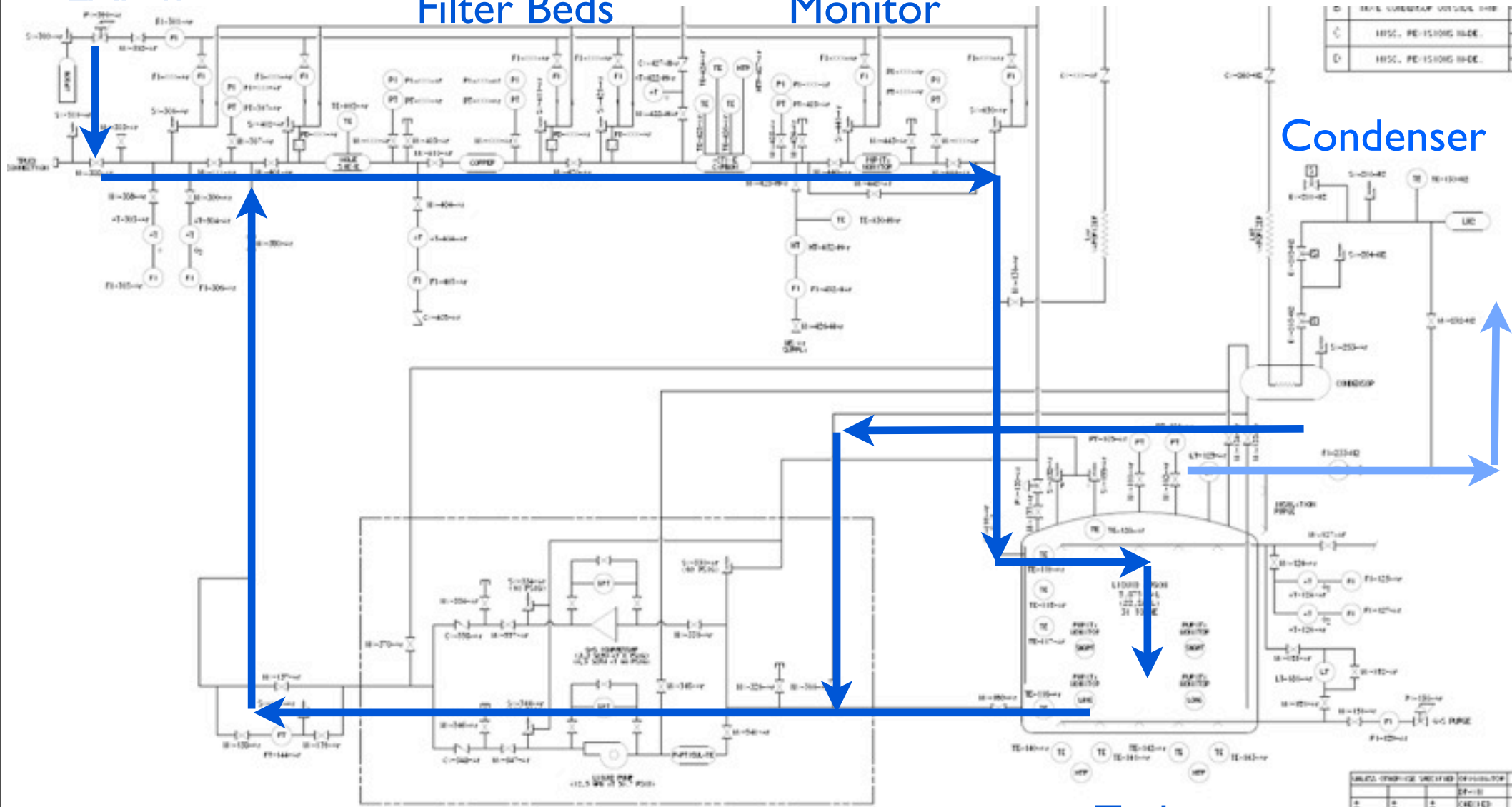
LAr In

Filter Beds

Condenser

Recirculation Pump

Tank





System Flow

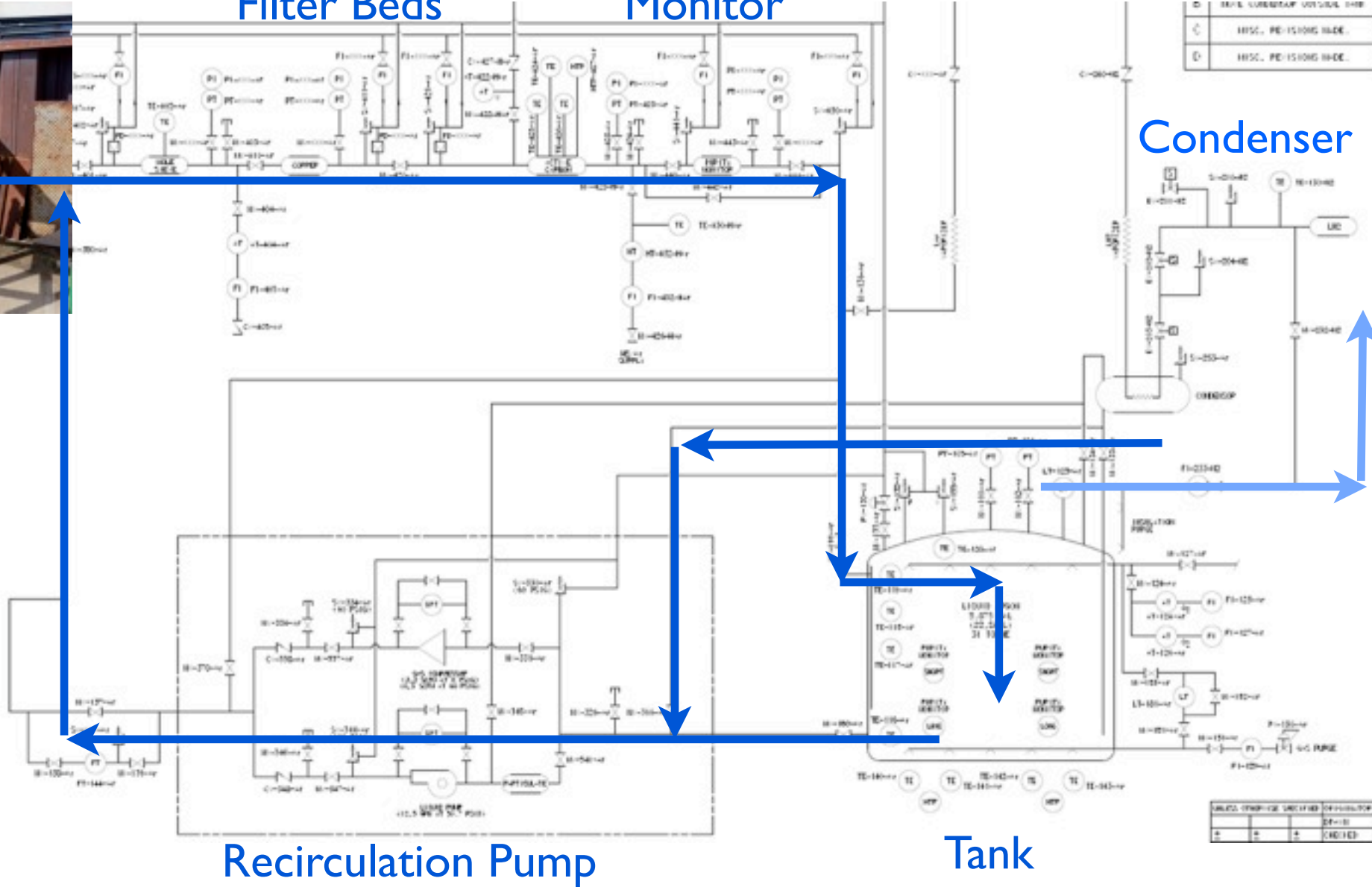
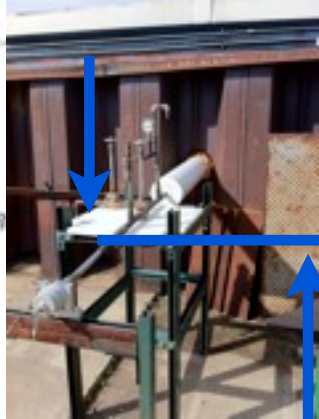
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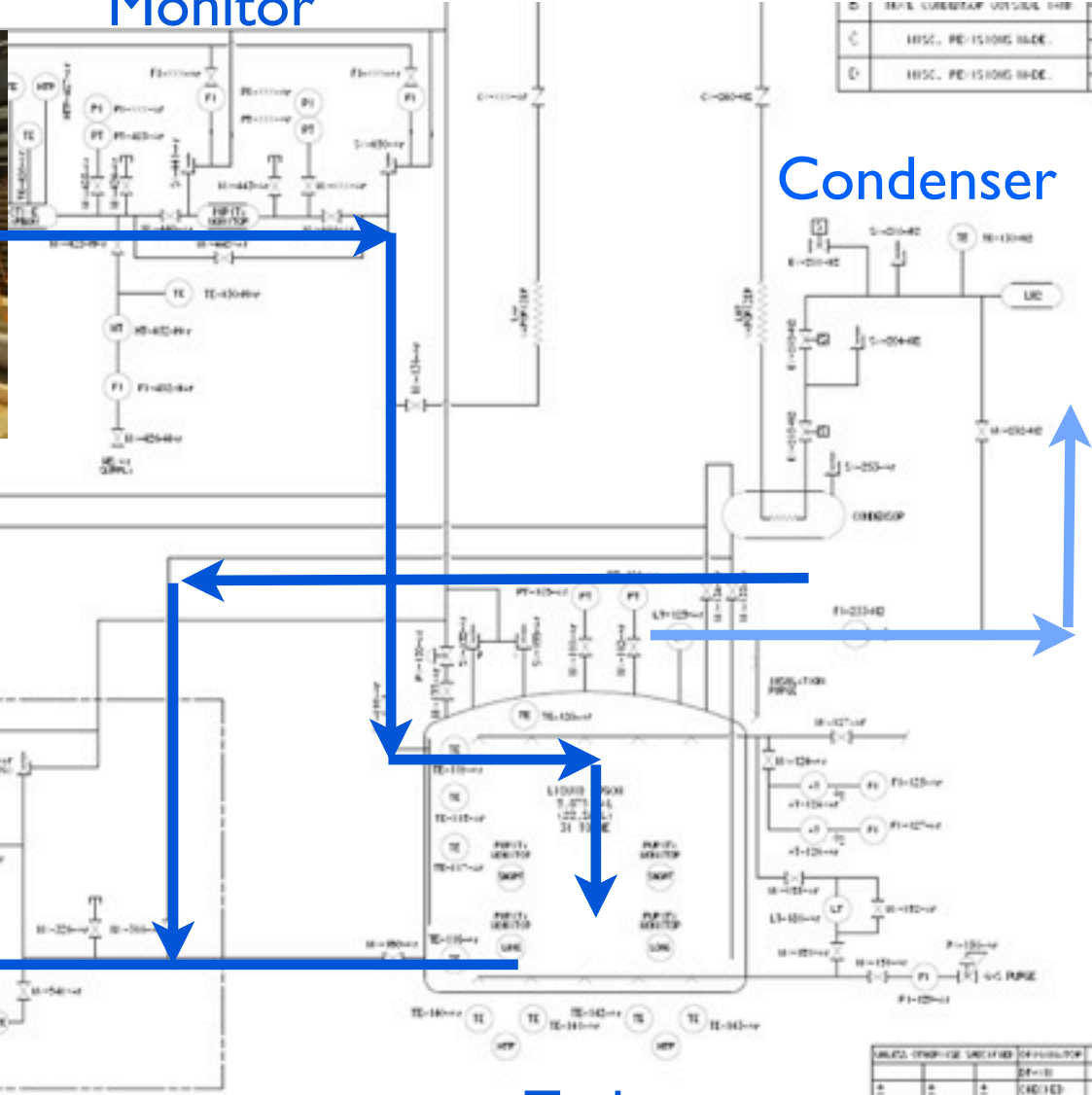
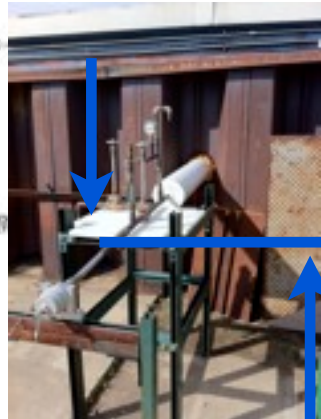
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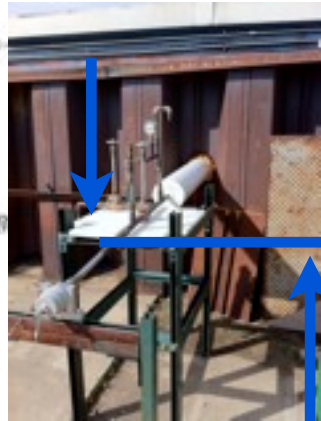


System Flow

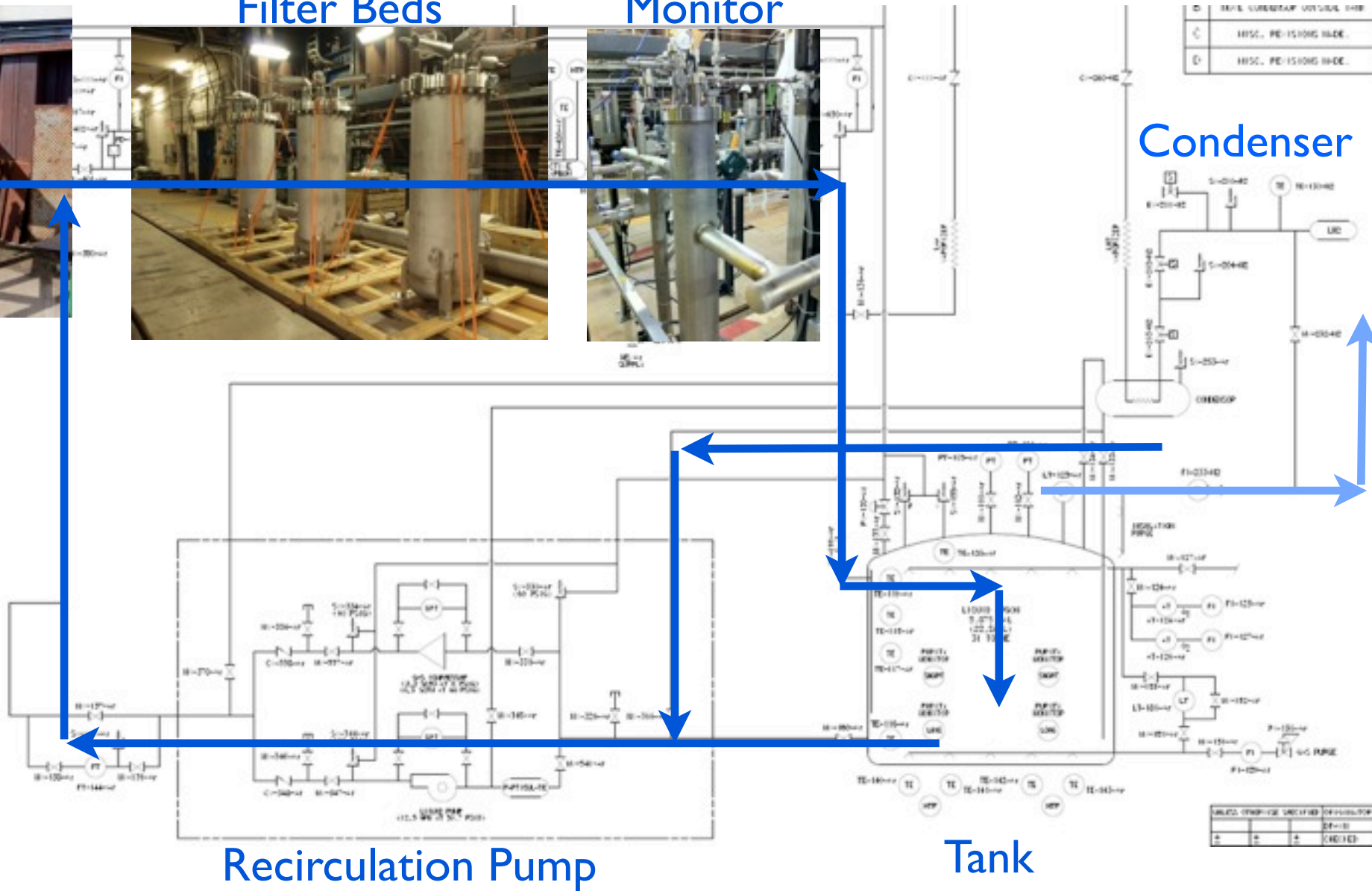
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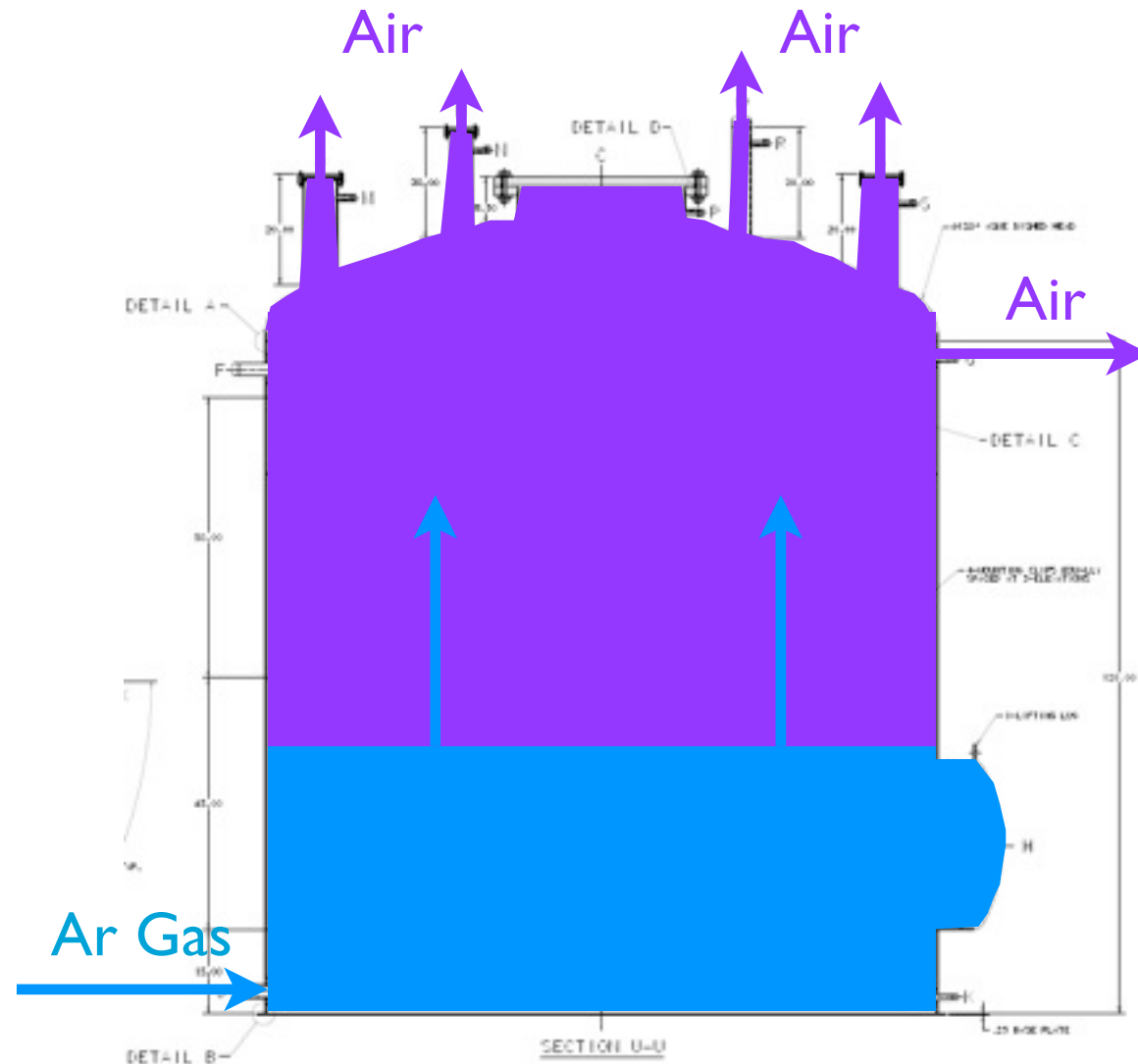
Recirculation Pump

Tank

Phase I - Purification without Evacuation



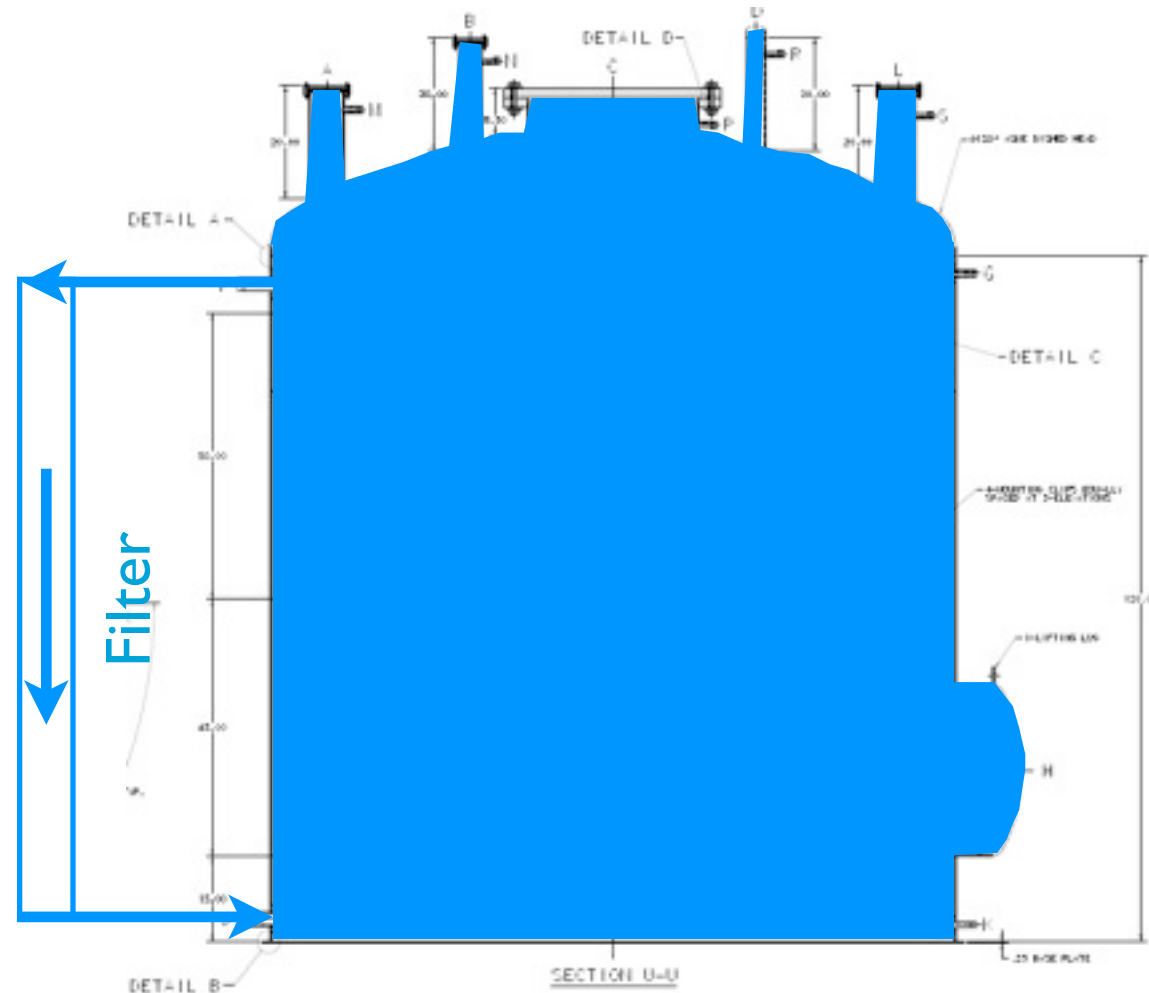
- Basic idea is to use an argon piston for initial purification
- Cycle a few volumes of clean, argon gas through the volume to push out ambient air and dry out surfaces
- Then recirculate the gas through filter system until the contamination level no longer decreases
- At that point we will fill with liquid argon



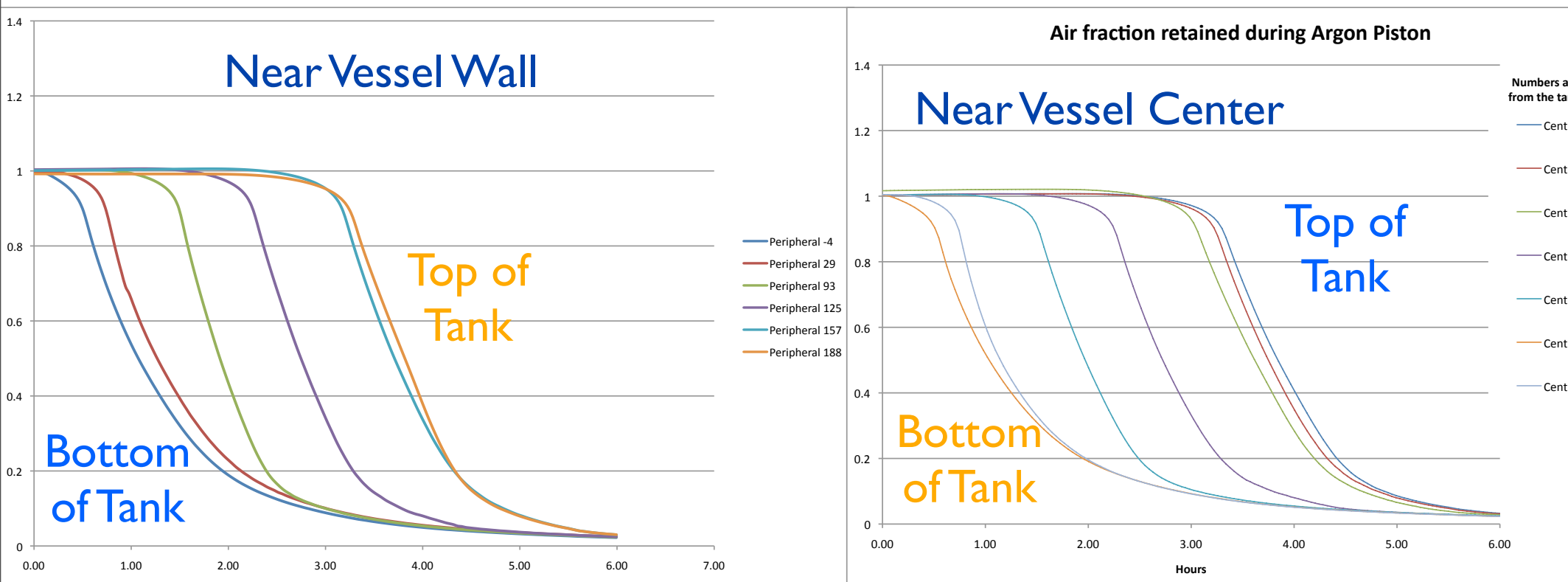
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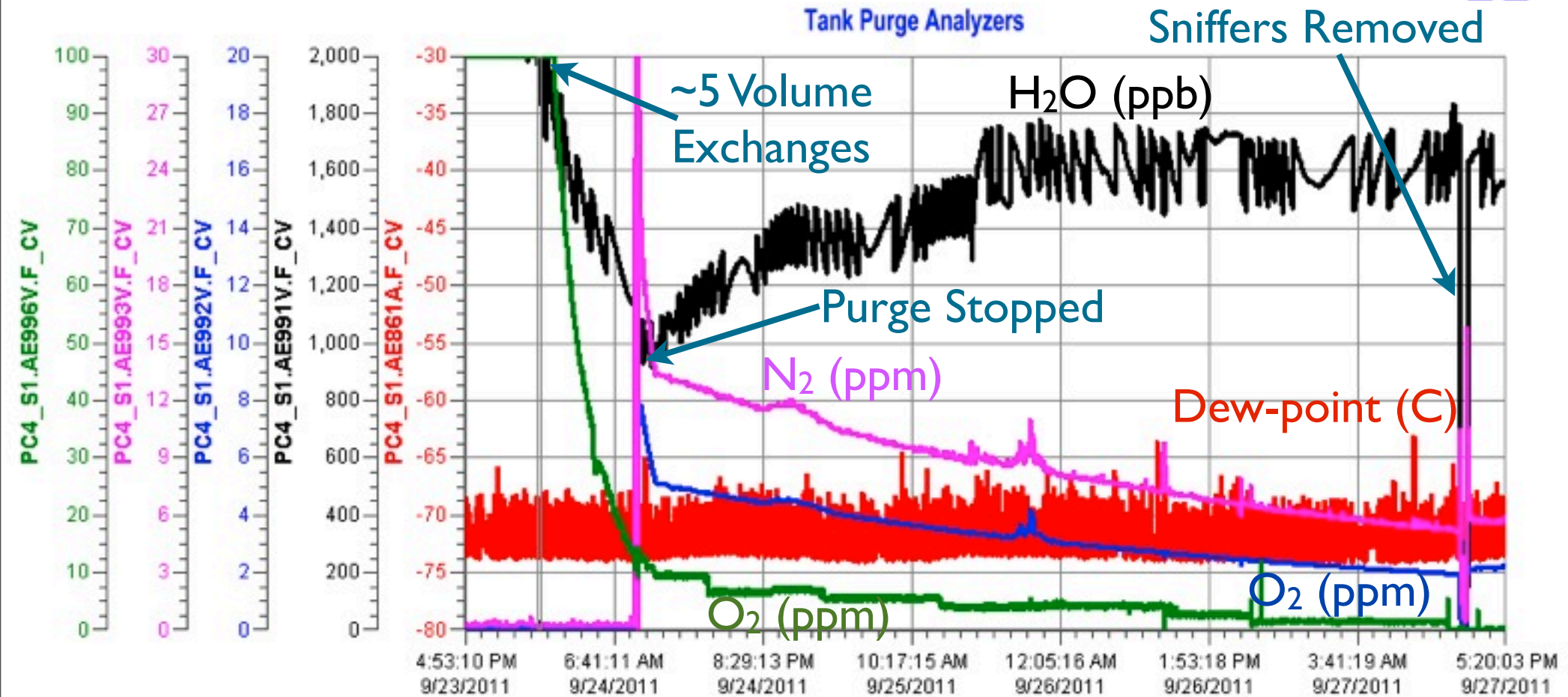


Gaseous Argon Purge




- Set of sniffer tubes monitored the oxygen content of the gas inside the vessel at various depths throughout the purge
- Plots show the content relative to the pre-purge state of the tank
- 1800 ppm of O₂ in tank after 2 volume exchanges (6 hours)
- 9.1 volume exchanges total before the purge was stopped

Gaseous Argon Purge



Pen Name	Description	Value	Eng Units	High Over Range	Low Over Range
PC4_S1.AE861A.F_CV	Dewpoint Meter (F_CV)	-73.5	C	0.0	-74.3
PC4_S1.AE991V.F...	Analyzer Halo H2O (F...	1,954.2	PPB	22,559.4	-2,962.9
PC4_S1.AE992V.F_CV	Analyzer Delta F O2 (F_CV)	0.1	PPM	50.1	0.0
PC4_S1.AE993V.F_CV	Analyzer Servomex N2 (F_...	0.1	PPM	97.8	-12.8
PC4_S1.AE996V.F_CV	Analyzer Delta F O2 (F_CV)	150.6	PPM	4,998.8	-0.5

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More to Come



- Gas recirculation starts tomorrow
- Liquid filling in about a week, that will be the real test of whether the process works
- Many thanks to every one who worked on this project